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Fourth-order solutions of nonlinear two-point boundary value problems by Newton-HSSOR iteration

ABSTRACT

In this paper, the Half-Sweep Successive Over-Relaxation (HSSOR) iterative method together with Newton scheme namely Newton-HSSOR is investigated in solving the nonlinear systems generated from the fourth-order half-sweep finite difference approximation equation for nonlinear two-point boundary value problems. The Newton scheme is proposed to linearize the nonlinear system into the form of linear system. On top of that, we also present the basic formulation and implementation of Newton-HSSOR iterative method. For comparison purpose, combinations between the Full-Sweep Gauss-Seidel (FSGS) and Full-Sweep Successive Over-Relaxation (FSSOR) iterative methods with Newton scheme, which are indicated as Newton-FSGS and Newton-FSSOR methods respectively have been implemented numerically. Numerical experiments of two problems are given to illustrate that the Newton-HSSOR method is more superior compared with the tested methods.

Keyword: Fourth-order scheme; Nonlinear two-point boundary value problem; SOR iteration